

Prescribing Pattern of Antibiotics in the General Pediatrics Ward of Tengku Ampuan Rahimah Hospital (HTAR): A Prospective Study

Norshazlin Md Zawawi¹, Sharmila Sathianathan¹, Navarasu Eddian², Manjeet Kaur Jas Beer Singh³, Nisanthidevi Sarangapani⁴, Nor Shafiqah N Nayan⁵, Aneetha Kaur Grewal⁶

¹ Tengku Ampuan Rahimah Hospital, Selangor, Ministry of Health Malaysia

² Telok Datuk Health Clinic, Selangor, Ministry of Health Malaysia

³ Bandar Botanik Health Clinic, Selangor, Ministry of Health Malaysia

⁴ Farmasi Sri Sai, Tanjung Malim, Perak, Malaysia

⁵ Sungai Buloh Hospital, Selangor, Ministry of Health Malaysia

⁶ Tun Hussein Onn National Eye Hospital, Selangor, Malaysia

Abstract

Introduction: The main issues with regards to antibiotics include choosing the correct antibiotic for the appropriate indication, dosage, and duration to achieve the optimum goal of therapy.

Objectives: To study the prescribing pattern of antibiotics in general paediatric wards of HTAR and to determine whether the prescribing of antibiotics was in accordance with the guidelines.

Method: A hospital-based cross-sectional prospective study was conducted to evaluate the prescribing pattern of antibiotics in paediatric inpatients. Data was extracted from the prescriptions issued during the month of August 2017 in the general paediatrics ward. All prescriptions of admitted patients who were prescribed with antibiotics were collected and followed up daily until patient was discharged. The data collected was analysed using Statistical Package for the Social Sciences (SPSS) software (Version 20).

Results: In total there were 545 antibiotics prescribed for 269 patients. It was found that the most prevalent disease among the patients was respiratory infections (56.5%). The most prescribed antibiotics among the general paediatric population were narrow spectrum antibiotics (71.1%) from the Penicillin class. Within the class of Penicillin, we found that Ampicillin was most frequently prescribed by the physicians. We found high adherence rate in the current medication management in the ward to the prescribing guidelines by (99.8%).

Conclusion: Our study highlighted that the antibiotics prescribed in the general paediatric wards of HTAR were mostly narrow spectrum antibiotics and the antibiotics were prescribed according to the guidelines. Further studies with bigger study population over a longer study period are needed to obtain higher impact results.

Keywords: antibiotic, prescribing pattern, paediatric

NMRR ID: NMRR-17-1763-36334

Corresponding Author: Norshazlin Binti Md Zawawi

Hospital Tengku Ampuan Rahimah, Jalan Chi Lung, 41200, Klang, Selangor, Malaysia.

Email: shazlin.zawawi@gmail.com

Introduction

Antibiotics are one of the commonly prescribed medications in both the community and hospital settings (1). Selection of appropriate antibiotics is the challenging part to the health care practitioners these days. Clinical practice guidelines play a vital role in providing guidance to the practitioner to select the best management for the patients while preventing the emergence of antimicrobial resistance. The main problems that they face in regards to antibiotics include choosing the correct drug for the appropriate indication, dosage, and duration to achieve the optimum goal of therapy (2).

Antibiotics are prescribed by the doctors for treatment or prevention of many types of bacterial infection (3). There are varieties of antibiotics, which are categorized either based on their chemical structures, mode of actions, or spectrum of activity. Antibiotics can be broadly categorized into six groups. The groups are penicillin, cephalosporin, aminoglycosides, tetracyclines, macrolides and fluoroquinolones.(4).

Antibiotics can be either broad spectrum or narrow spectrum based on the range of bacteria that have an antibiotic affect. The terms “narrow” or “broad” spectrum can be subjective, since some antibiotics can be broad but at the same time is narrower than the other broad antibiotics, and vice versa (5). The Penicillin group antibiotics such as penicillin and ampicillin are narrow spectrum antibiotics while some cephalosporin group antibiotics, tigecycline, piperacillin/tazobactam, polymyxins, carbapenem and amikacin are broad spectrum antibiotics (6,7).

The patterns of diagnosis and antibiotic choice did vary. A prospective observational study of drug utilization and antimicrobial prescription pattern among paediatrics cases in tertiary care hospital in India showed that the most frequently prescribed antibiotics were cephalosporins (43.6%) followed by penicillins. These antibiotics were commonly indicated for gastrointestinal tract infections (60.66%) followed by respiratory tract infection (27.2%). Most of the antibiotics were used as empirical treatment (8). Besides, a retrospective study of prescription pattern of antibiotics in paediatric inpatients at a tertiary care hospital in central India showed mean age of paediatric patients was 5.6 years old. The most common infections were acute gastroenteritis, followed respiratory tract infections, and meningitis. The results showed the most commonly prescribed antibiotics was cefexime and followed by amoxicillin-clavulanic acid combination from penicillin group (9). Another study on prescribing pattern of antibiotic in paediatric patients with pneumonia in India showed that the most commonly prescribed antibiotics for pneumonia was amoxicillin-clavulanic acid (43%) and ceftriaxone (36%). The mean age of the patients diagnosed with pneumonia was 26 months. Most patients (73%) were prescribed with single antibiotic then followed by 26% with two antibiotics (10).

However, there were inappropriate choice of antibiotic among paediatric patients shown by the following studies. A study done across six countries (Germany, Italy, South Korea, Norway, Spain, and the US in paediatric patients found that there was a vast difference in anti-microbial utilisation across these countries. Hence, they concluded that there was a need to optimise usage of anti-microbial in order to prevent resistance (11). A study conducted by Suparna Sharma *et al.* In 2016, proposed that Georgetown Public Hospital Corporation antibiotic's use were inappropriate. Antibiotics were prescribed for diagnosis like asthma and viral infections, which were not bacterial infectious disease. Broad spectrums antibiotics were prescribed as a first line therapy even when used for infectious diseases still requires careful judgement (12). This shows there is a need for antibiotic usage review.

In Malaysia, there were similar findings of inappropriate choice of antibiotic among patients. A study by Hassali MA *et al.* (13) to assess the general practitioner's attitude and knowledge on antibiotic prescribing for upper respiratory tract infections showed that many general practitioners prescribed antibiotics even when it was not required. Another study by V K *et al.* (14) conducted in six public hospitals in Malaysia found that there was a lack of adherence to guidelines in terms of antibiotic prescribing. Meanwhile, another study conducted in general paediatric wards across five different countries (Malaysia, United Kingdom, Germany, Hong Kong, and Australia) found that the most frequently prescribed medication was systemic anti-bacterial amounting to 25.2% (15). Another study by Boon Phiaw Kho *et al.* (16) in Sarawak, Malaysia reported that the antibiotic prescribing pattern for upper respiratory tract infections was found to differ between health care professionals and may be inappropriate. Lastly, a study by Teng *et al.* found high prescribing rate of antibiotics for febrile paediatric patients (17).

Since there is a lack of study focusing on the prescribing pattern of antibiotics in paediatric patients in Malaysia, this study will be targeting on general paediatric inpatient ward prescriptions containing antibiotics. The main objective of this study was to study the prescribing pattern of antibiotics in general paediatric wards and to determine whether the prescribing of antibiotics was in accordance to the guidelines.

Method

This was a cross sectional prospective study done to evaluate the prescribing pattern of antibiotics in the general paediatric ward of Tengku Ampuan Rahimah Hospital (HTAR), Klang. All prescriptions prescribed for patients who were admitted in paediatric wards 6A, 6B, and 7D of HTAR during the whole month of August 2017 were collected. The targeted sample size was 262 based on average admission of 817 per month calculated by using Raosoft formula.

Only complete prescriptions were included in the study. All incomplete prescription without age, gender, diagnosis, antibiotic prescribed, class of antibiotics, dose of antibiotic prescribed, frequency, duration of treatment and prescriber's status was excluded from this study. In addition, prescription from the

Paediatric High Dependency Unit, Neonatal Intensive Care Unit and Special Care Nursery, and prescription for transfer-in patient from other hospitals were also excluded.

A validated data collection form was developed by the pharmacists from HTAR with reference to Chunnillal D *et al.* (2015) (18). Data was extracted from the included prescriptions using the data collection form. Baseline demographic, such as age, gender, diagnosis was collected as well as antibiotic prescribed, class of antibiotics, dose of antibiotic prescribed, frequency, duration of treatment, and prescriber's status. The data that was collected was analysed descriptively using Statistical Package for the Social Sciences (SPSS) software (Version 20).

This study was done in HTAR with the verbal approval from Paediatric Head of Department. No informed consent is required as data was merely collected from prescriptions without any intervention and no patient identifiers. Ethics approval was also obtained from Malaysian Research Ethics Committee (MREC).

Results

During the study period, a total of 544 prescriptions of antibiotics were prescribed for 269 patients in the paediatric wards in HTAR. Among the patients that were included in this study, the highest number of patients were in age group between 1 to 5 years old (54.6%) and lowest number were in age group above 5 to 12 years of age (14.5%). The percentage of male and female patients was almost equal with 57.2% of male and 42.8% female, respectively. The most prevalent disease among the studied patients was respiratory tract infections (56.5%) followed by ear, nose and throat (ENT) infections (13.8%), and gastrointestinal infections (5.2%) being in third position. Other disease encountered during the study was as per Table 1.

Table 1: Demographic and diagnosis distribution (n= 269)

Demographic	n (%)
Age group	
<1 year	83 (30.9)
1-5 years	147 (54.6)
>5-12 years	39 (14.5)
Gender	
Female	115 (42.8)
Male	154 (57.2)
Sites of infection	
Blood	5 (1.9)
Brain	6 (2.2)
ENT	37 (13.8)
Gastrointestinal	14 (5.2)
Nephrology	6 (2.2)
Respiratory	152 (56.5)
Skin	3 (1.1)
UTI	12 (4.5)
Others	34 (12.6)

Abbreviation: ENT - ear, nose and throat; UTI – urinary tract infection

Our study found that penicillin was the most prescribed antibiotic, at 55.9%, followed by cephalosporin at 22.4%. The least prescribed antibiotics in paediatric ward in HTAR belonged to quinolones with 0.4%. As penicillin class of antibiotic was the frequently prescribed class, we further analysed and found that ampicillin was ranked the highest in the penicillin class, followed by penicillin antibiotic (48.4% and 22.0% respectively) (Table 2).

Based on the 544 prescriptions of antibiotics reviewed in the paediatric wards in HTAR, approximately 156 prescriptions were prescriptions for broad-spectrum antibiotics and 388 prescriptions for narrow spectrum antibiotics. It was noted that narrow spectrum antibiotics was the most frequently

prescribed to paediatric patients in the ward followed by broad spectrum antibiotics with the percentage of 71.3% and 28.7% respectively (Table 2).

Table 3 showed that 99.8% of the prescriptions with antibiotics were prescribed correctly to patient in the paediatric ward in terms of indication, dose and route of administration according to the National Antibiotic Guidelines (NAG) (19), Pediatric Protocols 3rd Edition (20), Lexicomp (4) and Frank Shann 17th Edition (2017) (21).

Table 2: Classes of antibiotics prescribed, types of penicillin antibiotics and broad spectrum versus narrow spectrum antibiotics (n=544)

Prescribing Pattern	n (%)
Classes of antibiotics prescribed	
Penicillin	304 (55.9)
Cephalosporin	122 (22.4)
Macrolide	86 (15.8)
Aminoglycoside	16 (2.9)
Carbapenem	6 (1.1)
Quinolones	2 (0.4)
Others	8 (1.5)
Types of Penicillin antibiotics prescribed	
Ampicillin	147 (48.4)
Penicillin	67 (22)
Amoxicillin	45 (14.8)
Cloxacillin	24 (7.9)
Amoxicillin/Clavulanic Acid	20 (6.6)
Piperacillin/Tazobactam	1 (0.3)
Broad Spectrum versus Narrow Spectrum	
Narrow	388 (71.3)
Broad	156 (28.7)

Table 3: Appropriateness of antibiotic prescribing (indication, dose and route of administration) according to the guidelines (n=544)

Prescription According to Guideline	n (%)
Yes	543 (99.8)
No	1 (0.2)

Discussion

Antibiotics are usually prescribed empirically upon diagnosis and subsequently are adjusted according to the culture and sensitivity results (22). In the paediatric departments, antibiotics were the most commonly prescribed medications and one of the main drugs prescribed (23). This study was carried to determine the prescribing patterns of antibiotics in the general paediatric wards of HTAR, Klang, Malaysia.

When analysed according to the age distribution, higher number of patients belonged to the age group of more than 1-5 years. This was common because at this age, the children's immune system is still developing (24). According to a study by Pradeepkumar *et al.* (2017), it was found that the median age of paediatric patients receiving antibiotic was 3 years old, and the age group that received antibiotics more frequently than other children was patient with age group below 1-year-old. This indicated that patient with age group of below 1-year-old was more susceptible to infectious diseases (25). Less percentage was observed in the children of age group more than 5-12 years (14.5%). However, our study population had an approximately equal gender distribution not statistically affecting our results (26).

In our study, a total of 269 patients with 544 antibiotics prescriptions were recorded in the duration of one month. Penicillin was widely prescribed for our paediatric patients followed by cephalosporins. Our results were comparable to Suparna Sharma *et al.* (12) who also found that penicillin group antibiotics were

frequently prescribed at a frequency as high as 51.4%. Amoxicillin was the drug of choice (33.9%) and the various diagnoses found were asthma (20 %), respiratory infections (19.5 %), and gastrointestinal infections (12.1 %). It was not surprising that the quinolones are prescribed in caution due to the fear of adverse effects such as arthralgias (27).

In our study, only 28.7% of the prescriptions contained broad spectrum antibiotics while the remaining were narrow spectrum antibiotics. The commonly prescribed antibiotic was narrow spectrum antibiotic, and as per the recommendations in the guidelines. This study, however, did not verify the culture and sensitivity results. In contrast, another study found that only 27% of providers prescribed narrow-spectrum therapy in the emergency department, but more narrow spectrum antibiotics were prescribed during discharge (56%) (28). This could be due to different guidelines being practiced. Antibiotics use is influenced by the preference of hospital doctors, experience using the antibiotics, availability of medication, and also publicity by the pharmaceutical industries (28).

Appropriate usage and doses of antibiotics for the treatment in paediatric ward were analysed by referring to the guidelines such as the National Antibiotic Guidelines (NAG) (19), Lexicomp (4), Frank Shann (21) or Pediatric Protocols (20). From the collected data, ampicillin from penicillin class was the major antibiotic prescribed in the wards for respiratory infection treatment. According to the NAG (19), ampicillin is one of the preferred antibiotics for respiratory infection. Therefore, it showed that the prescribed antibiotics were given correctly according to guidelines in the ward.

The limitation of this study was that the data collection duration was only one month. This may impose limitation for seasonal variation. Besides, this was a single-centred study conducted in the general paediatric patients only and all cases from the Paediatric High Dependency Unit, Neonatal Intensive Care Unit, and Special Care Nursery were excluded. Hence, generalization of the observed results from this study to other paediatric population was not possible. Future study should include other paediatric population and duration of the study should be extended quarterly for a year in order to allow generalization and to prevent bias.

Conclusion

Our study highlighted that antibiotics prescribed in the general paediatric wards of HTAR were mostly narrow spectrum antibiotics and the antibiotics prescribing was done according to the guidelines. Further studies are needed with extensive collaboration with physicians and microbiologists to obtain higher impact results in terms of culture and sensitivity, diagnosis, and bigger study population over a longer study period. Continuing education about rational drug use and development of easy to use treatment guidelines for common diseases in the paediatric wards are highly recommended to ensure the sustainability of good practices.

Acknowledgement

We would like to thank the Director General of Health Malaysia for his permission to publish this article. Also, we would like to thank the Department of Pharmacy and Department of Paediatrics of HTAR for their support and cooperation in this study.

Conflict of Interest Statement

No external funding was received and the authors declared no conflict of interest.

References

1. Thapaliya K, Shrestha S, Bhattarai S, Basnet D. Prescribing Pattern of Antibiotics in Pediatric Hospital in Chitwan District in Nepal. 2015;4(11):1631–41.
2. Leekha S, Terrell CL, Edson RS. General principles of antimicrobial therapy. *Mayo Clin Proc.* 2011;86(2):156–67.
3. Drexler M. What You Need to Know About Infectious Disease [Internet]. 2010. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK209706/>
4. Comp L. Lexi Comp. 2018.
5. Sarpong EM, Miller GE. Narrow- and broad-spectrum antibiotic use among U.S. children. *Health Serv Res.* 2015;50(3):830–46.

6. Liew YX, Krishnan P, Yeo CL, Tan TY, Lee SY, Lim WP, et al. Surveillance of broad-spectrum antibiotic prescription in Singaporean hospitals: A 5-year longitudinal study. *PLoS One*. 2011;6(12):6–11.
7. Williams DJ, Hall M, Shah SS, Parikh K, Tyler A, Neuman MI, et al. Narrow Vs Broad-spectrum Antimicrobial Therapy for Children Hospitalized With Pneumonia. *Pediatrics* [Internet]. 2013;132(5):e1141–8. Available from: <http://pediatrics.aappublications.org/cgi/doi/10.1542/peds.2013-1614>
8. Vivek Virbhan Bamel^{1*}, Savita Ramesh Shahani¹ NCM, ¹Department. *IJBCP International Journal of Basic & Clinical Pharmacology Original Research Article* Study of drug utilization pattern in emergency medicine ward at a tertiary care teaching hospital. 2017;6(4):868–73.
9. Mangesh DSN and MM. A Study of Prescription Pattern of Antibiotics in Paediatric In- Patients at a tertiary care hospital in central India. *Int J Pharmacol Res*. 2016;6.
10. Moinuddin K, Altaf M, Kishore G. Study of prescribing pattern of antibiotic in pediatric patients with pneumonia. *J Appl Pharm*. 2012;3(04):606–13.
11. Youngster I, Avorn J, Belleudi V, Cantarutti A, Díez-Domingo J, Kirchmayer U, et al. Antibiotic Use in Children – A Cross-National Analysis of 6 Countries. *J Pediatr* [Internet]. 2017;182:239-244.e1. Available from: <http://dx.doi.org/10.1016/j.jpeds.2016.11.027>
12. Sharma S, Bowman C, Alladin-Karan B, Singh N. Antibiotic prescribing patterns in the pediatric emergency department at Georgetown Public Hospital Corporation: A retrospective chart review. *BMC Infect Dis* [Internet]. 2016;16(1):4–9. Available from: <http://dx.doi.org/10.1186/s12879-016-1512-4>
13. Hassali MA, Kamil TKT, Md Yusof FA, Alrasheedy AA, Yusoff ZM, Saleem F, et al. General practitioners' knowledge, attitude and prescribing of antibiotics for upper respiratory tract infections in Selangor, Malaysia: Findings and implications. *Expert Rev Anti Infect Ther*. 2015;13(4):511–20.
14. Lim, VKE; Cheong YMSA. Pattern of antibiotic. 0:525–8.
15. Rashed AN, Wong ICK, Wilton L, Tomlin S, Neubert A. Drug Utilisation Patterns in Children Admitted to a Paediatric General Medical Ward in Five Countries. *Drugs - Real World Outcomes*. 2015;2(4):397–410.
16. Kho BP, Ong CMY, Tan FTY, Wee CY. Antibiotic prescribing for upper respiratory tract infections in sarawak district hospitals. *Med J Malaysia* [Internet]. 2013;68(2):136–40. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23629559>
17. Teng, C.; Nik-Sherina, H.; Ng, C.; Chia Y. A. Antibiotic prescribing for childhood febrile illness by primary care doctors in Malaysia. *J Paediatr Child Health* [Internet]. 2006;Volume 42(10):612–7. Available from: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1440-1754.2006.00937.x>
18. Chunnillal D, Peer A, Naidoo I, Essack S. An evaluation of antibiotic prescribing patterns in adult intensive care units in a private hospital in KwaZulu-Natal. *South African J Infect Dis* [Internet]. 2015;30(1):17–22. Available from: <http://www.tandfonline.com/doi/full/10.1080/23120053.2015.1103956>
19. National Antibiotic Guideline [Internet]. Available from: <https://www.pharmacy.gov.my/v2/en/documents/national-antibiotic-guideline-nag-2nd-edition.html>
20. Hussain Imam Hj Muhammad, Ismail Ng Hoong Phak TT. *Malaysian Paediatric Protocol 3rd edition*. Kementerian Kesihatan Malaysia. 2012.
21. Frank Shann Drug Doses. 2017.
22. Bytyqi HQ, Hoxha R, Bahtiri E, Krasniqi V, Krasniqi S. Antibiotic Utilization in Pediatric Hospitalized Patients – A Single Center Study. *Open Access Maced J Med Sci* [Internet]. 2017;5(2):256–60. Available from: <http://www.id-press.eu/mjms/article/view/oamjms.2017.045>
23. Choudhury DK, Bezbaruah BK. Antibiotic prescriptions pattern in paediatric in-patient department gauhati medical college and hospital, Guwahati. *J Appl Pharm Sci*. 2013;3(8):144–8.
24. Simon AK, Hollander GA, McMichael A. Evolution of the immune system in humans from infancy to old age. *Proc R Soc B Biol Sci*. 2015;282(1821).
25. Bhupalam, Pradeepkumar, Tawfeek Alameri, Goruntla Narayana YPR, Ramaiah JD. Sonographic Determination of Liver and Spleen Sizes in Patients with Sick Cell Disease at Gombe , Nigeria. *CHRISMED J Heal Res*. 2017;5(3):182–6.
26. Muenchhoff M, Goulder PJR. Sex differences in pediatric infectious diseases. *J Infect Dis*. 2014;209(SUPPL. 3).
27. JenniferL.Goldman KP and. Safety Concerns Surrounding Quinolone Use in Children. *J Clin Pharmacol*. 2016;56 (9):1060–75.
28. M.M. R, M.J. C, D. A, M. S. Antibiotic use for pneumonia among children under-five at a pediatric hospital in Dhaka city, Bangladesh. *Patient Prefer Adherence* [Internet]. 2017;11:1335–42. Available from: <https://www.dovepress.com/getfile.php?fileID=37773%0Ahttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexa&NEWS=N&AN=617837178>